New cooling sequences for old white dwarfs

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We present full evolutionary calculations appropriate for the study of hydrogen-rich DA white dwarfs. This is done by evolving white dwarf progenitors from the zero age main sequence, through the core hydrogen burning phase, the helium burning phase and the thermally pulsing asymptotic giant branch phase to the white dwarf stage. Complete evolutionary sequences are computed for a wide range of stellar masses and for two different metallicities: $Z = 0.01$, which is representative of the solar neighborhood, and $Z = 0.001$, which is appropriate for the study of old stellar systems, like globular clusters. During the white dwarf cooling stage we compute self-consistently the phase in which nuclear reactions are still important, the diffusive evolution of the elements in the outer layers and, finally, we also take into account all the relevant energy sources in the deep interior of the white dwarf, like the release of latent heat and the release of gravitational energy due to carbon-oxygen phase separation upon crystallization. We also provide colors and magnitudes for these sequences, based on a new set of improved non-gray white dwarf model atmospheres, which include the most up-to-date physical inputs like the Lyα quasi-molecular opacity. The calculations are extended down to an effective temperature of 2,500 K. Our calculations provide a homogeneous set of evolutionary cooling tracks appropriate for mass and age determinations of old DA white dwarfs and for white dwarf cosmochronology of the different Galactic populations.